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"Computational assessment of dynamic patellofemoral cartilage loading in adolescent patients with and without patellofemoral instability"

Patellofemoral (PF) instability is a very common musculoskeletal disorder involving lateral patellar subluxation or dislocation. This condition is most common during adolescence and it is also one of the most common referrals seen and treated by the Orthopaedic Surgery team at CHEO. These patients are at very high risk of repeat dislocations, which is devastating and can lead to longstanding knee pain, inability to participate in sports or activities, and decreased quality of life. Numerous anatomic risk factors have been identified to cause abnormal movement of the patella leading to increased stress on the cartilage of the PF joint. While conservative treatment with bracing and physiotherapy can be successful, many of these patients go on to require surgical management, which is aimed at stabilizing the PF joint by normalizing patellar tracking to decrease pain and minimize cartilage stress. Within the adolescent population, there exists a lack of knowledge on how individual anatomic factors contribute to PF maltracking and cartilage stress, and thus how to effectively tailor surgical treatment. Biomechanical studies have attempted to better understand these differences using computer models to simulate joint function but are limited in how accurately they can simulate "real life" scenarios. Newer techniques have allowed for the combination of computer technology with advanced motion capture imaging to create patient-specific models that more accurately simulate joint function. This technology has not yet been applied to adolescent patients with PF instability. This study aims to use this technology to compare PF cartilage stress and loading between patients with and without PF instability. By having a better understanding of PF joint loading, treatment options can be targeted more effectively to each individual patient and their anatomy. Future application of this technology may allow for simulation of surgery and assessment of joint function after surgery. Ultimately, adolescent PF instability is an extremely common condition, and this project aims to use a novel and practical approach to studying it and improving both our biomechanical and clinical understanding.